

form his theory of the formation of the parallel roads of Glen Roy. We have a glimpse of his well-known tone of thought in the question which he says, in one of these essays, one *naturally* asks, "What was the use of this great engine set at work ages ago to grind, furrow, and knead over, as it were, the surface of the earth?" and finds as an answer that it was a special provision for making the surface fertile by ploughing it deeply and preparing it as a grain-growing soil. Perhaps we could not have a better justification for calling teleological arguments "barren virgins," with Prof. Huxley, than this instance, for if the glacial period were a special provision for the wants of man, we should be cut off from the conclusions, now almost proved by evidence, first that man existed in these isles *before* the glacial epoch, and second, that this epoch should rather be called the *last* glacial epoch, as there have been similar ones throughout geologic time. This last conclusion, involving the extension of glacial conditions through a long range of time, at various intervals, a conclusion largely due to Prof. Ramsay, will be only second in importance, when fully established to its extension in space so conclusively proved by Agassiz and others. The longest of the five papers in this collection is the most recent: "On the Physical History of the Valley of the Amazons," in which he gives his reasons for considering the whole of that valley to have been filled with ice, and to have extended much further to the east at that period. This is scarcely the place for discussing conclusions that have been made known in a larger work with the evidence stated; but we may call attention to the fact that no furrows, striæ, or polished surfaces are anywhere to be found there, and the evidence, therefore, is not of that positive character that so remarkable a conclusion would seem to demand. The country is so little known that at any time fresh observations might modify any conclusion drawn from negative or secondary evidence.

To the Victoria Falls of the Zambesi. Translated from the Original German of Edw. Mohr. By N. D'Anvers. (London: Sampson Low and Co., 1876.)

In noticing the German edition of this work (NATURE, vol. xii. p. 231) we said that it was well worth translating into English, and we are therefore glad to see that Messrs. Low and Co. have put it within reach of the English reading public. The work is full of interest, and is a really valuable contribution to our knowledge of the region traversed—from D'Urban to the Victoria Falls of the Zambesi. Mr. D'Anvers has done his work of translating very satisfactorily, judiciously omitting a few passages which deal with matter already brought before English readers. All the original illustrations seem to have been retained, including the brilliant but tasteful chromo-lithographs. A new route-map, on a larger scale than the one in the German edition, has been constructed for this translation.

Sport in Abyssinia, on the Mareb and Tackazee. By the Earl of Mayo. (London: John Murray, 1876.)

THE Earl of Mayo seems to have published this book to show intending sportsmen in Abyssinia how not to do it. His expedition, organised solely for sport, was rather an unfortunate one. Very little sport was obtained by the author, and ere he had well set to work, he was taken so ill that he had suddenly to return to Massowah to catch a homeward-bound steamer. The work contains some shrewd observations on Abyssinian people and affairs, and will no doubt be appreciated by sportsmen.

Health in the House. By Catherine M. Buckton, Member of the Leeds School Board. Sixth edition. (London: Longmans and Co.)

THIS useful book consists of twenty-five lectures on Elementary Physiology in its application to the daily wants of Man and Animals, delivered to the wives and children

of working-men in Leeds and Saltaire. It will be found a great help to national schoolmasters and others engaged in education, who may desire to give their pupils clear ideas of the structure and life of man, together with a practical knowledge of the necessity of fresh air and cleanliness in their daily life. At the end of the book will be found questions on some of the lectures, a list of works useful for preparing lectures, and tables of foods most suitable for health.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

Corrections in the Address of the President of the Royal Microscopical Society (Vol. xiii. p. 332)

By some unaccountable oversight in copying out the data for calculating the number of molecules of liquid water, the factor expressing the specific gravity of the vapour of water was omitted, and afterwards overlooked. The number of atoms of a gas should really be multiplied by $\frac{2}{3} \times 770 \times \frac{1}{6239} \times \frac{1}{2} = 617$. But

moreover, on reflecting on the relative reliability of the determinations by the various authors of the number of the atoms in gases, it appears that in taking the mean, greater weight ought to be allowed to that by Clerk-Maxwell, since founded on more recent and accurate data. If his results be considered as of equal value to those of Storey and Thomson combined, the mean would be reduced to so nearly the same extent as the molecules of liquid water would be increased by the above-named correction, that the numbers given in the address may be considered to be as good an approximation to the truth as can be determined in the present state of the question, and none of the general conclusions need be modified. H. C. SORBY

Vivisection

I HOPE that you will permit me to call attention to a passage in the "Statement of the Society for the Protection of Animals liable to Vivisection on the Report of the Royal Commission on Vivisection" (published by the Society, 1, Victoria Street, Westminster). Under the heading "Extracts of Evidence on Extension of the Practice of Vivisection, and Abuses connected therewith," the following words occur (p. 22):—

"Dr. Crichton Brown describes:

"Forty-six animals sacrificed in trying if chloral were antagonistic to picrotoxine. Cases of poisoning by picrotoxine are of very rare occurrence. Twenty-nine animals used in Ferrier's series."

I will leave your readers to judge of the kind of impression which this passage tends to give; I will only ask, is it in accordance with the ordinary principles of justice that the following important details (also gathered from Dr. Crichton Brown's evidence) should be entirely omitted by the compilers of the Statement?

1. "Picrotoxine is sold in large quantities as Barber's poisoned wheat for the destruction of birds" (3218). Concealed in an edible substance, this poison must therefore pass largely through the hands of an ignorant and careless class of persons.

2. Dr. Crichton Brown "succeeded in proving that after a poisonous dose of picrotoxine has been given to an animal, if a dose of chloral be given subsequently the animal will recover" (3163).

3. The operation to which the animals sacrificed were subjected "consisted in the introduction under the skin of a little fluid by means of a perforated needle . . . the pain is infinitesimal" (3218).

4. The after effects are convulsions and death, and "convulsions themselves are not necessarily painful" (3218). This is proved by direct and distinct evidence.

5. In consequence of the use made of Barber's poisoned wheat, "numbers of animals die of it in convulsions every year" (3218). It is almost incredible that a course of action which may result in saving human life should be mentioned in the manner above quoted; while a course of action identical as far as the ultimate effect on the animals is concerned, in which

there is no question of saving life, and which is repeated a thousand times for the private benefit of its performers, is omitted!

6. In Dr. Ferrier's research, anæsthetics were so "carefully and liberally given," that five animals out of the twenty-nine sacrificed "died before they were touched or operated on in any way" (3178).

FRANCIS DARWIN

Down, Beckenham

The Use of the Words "Weight" and "Mass"

IN a letter with the above heading published in NATURE, vol. xiii. p. 325, Mr. Bottomley has recommended that the ambiguity of the word weight shall be avoided by using the phrase "the gravity of a pound" when we mean the downward force due to the earth's attraction upon a pound weight.

The ambiguity against which Mr. Bottomley wishes to guard is a very real one. Not to speak of common usage, which allows three meanings of the word weight to be loosely intermingled, we have two of these meanings adopted into scientific nomenclature. The universal practice in chemistry is to employ the word weight to signify mass, and anyone may satisfy himself that this use of the word could not be dispensed with in that science by making the attempt to substitute other forms of expression for the convenient words weight, heavy, light, heavier, lighter, as used by chemists. On the other hand, physicists have generally employed the term to signify a force, and the best writers on mechanics are careful to avoid using it to express mass.

But I fear Mr. Bottomley's remedy, if adopted, would introduce quite as serious, perhaps a more serious, ambiguity. Gravity is an acceleration. When we say that gravity is less in a balloon or in a mine than at the surface of the earth, or greater at Glasgow than at Manchester, we are speaking of alterations of g —the acceleration due to the earth's attraction; and it would create confusion to employ this word to designate forces also.

But a practice which I adopted in lecturing on mechanics in Queen's College, Galway, many years ago seems to meet the difficulty, and may perhaps recommend itself to other teachers. It is to use the word *gravitation* in the proposed sense.

If this were done, *gravity* at Glasgow would mean an acceleration; the *gravitation* of a kilogramme there would be a force; and *weight* would continue a word of doubtful import, to be judged of by the context, sometimes used for a force, sometimes for a mass, and sometimes for those pieces of metal which are employed as measures in weighing (as in the phrases "a set of weights," "a gramme weight"). In further support of my suggestion, it may be observed that the proposed use of the substantive *gravitation* follows legitimately in the English language from the established meaning of its correlative, the verb *gravitate*.

I would wish to take this opportunity of also recommending a prefix which I have found of the utmost service both to students by assisting them to acquire clear conceptions with ease, and to myself. We use the prefix *hyper* placed before the name of any metrical weight, as hyper-decigramme, hyper-gramme, hyper-hektogramme, hyper-kilogramme, hyper-tonne, to indicate those forces of the absolute metrical series which are slightly larger in amount (about 2 per cent. more) than the gravitation at the earth's surface of the decigramme, gramme, hektogramme, &c., respectively.

When a student has to use weights as forces, as he must in the laboratory, he should be trained from the beginning to think of them in their relation to the neighbouring absolute forces. For instance, if he uses a hektogramme to exert a pressure, he should

be encouraged to think of it rather as $\frac{2}{10}$ ths of a hyper-hektogramme (which is a force) than as a hektogramme (which is more properly a mass). This will also keep prominently before his mind that the amount of the pressure depends on the station at which the experiment is made. G. JOHNSTONE STONEY
Queen's University, Ireland, March 9

MR. BOTTOMLEY remarks in his letter on weight and mass that appeared in NATURE, vol. xiii. p. 325, that "During the present session we have aided ourselves in Glasgow with four very important helps to the teaching of the kinetic system of force-measurement. . . . The third help is the construction by Prof. Thomson, for the first time so far as I know, of spring balances for indicating poundals and kilodynes."

Will you permit me to point out that about three years ago Prof. Ball, when introducing the C. G. S. system of units into the course of mechanics at this college, had a series of dynamometers in absolute measure specially constructed by Messrs. Salter, of West Bromwich. These dynamometers were exhibited at the Bradford meeting of the British Association, and will also be seen at the forthcoming Loan Exhibition at the South Kensington.

W. F. BARRETT

Royal College of Science, Dublin

Metachromism

MR. FLINDERS PETRIE in his interesting letter (vol. xiii. p. 348) criticises the abstract of my paper which appeared in NATURE some weeks ago. Before considering his communication, I would remark that my argument against Schönbein's theory accounting for metachromism is based upon the colour relation which he mentions. I gave a small table of anhydrous binary compounds which conform to the rule, and that table includes the chlorides of chromium which Mr. Petrie has pushed out into the cold. The relation is thus referred to:—"Those compounds in a series which show the highest amount of the basylous element have the most refrangible colours." So far as I am aware, it is there announced for the first time.

For the sake of clearness we will first examine Mr. Petrie's proposition:—"Increase of the electro-negative element produces a colour-change towards the red end of the spectrum, and *vice versa*."

Increase of the electro-negative element is accompanied by less refrangible colours, but to say that this increase produces the change is going farther than the observations warrant, is, in short, opposed to fact. For example, if we take the series of oxides of chromium which he gives— Cr_2O_3 green, CrO_2 yellow green, CrO_3 red, I fail to see that increase of the electro-negative element, *i.e.*, colourless oxygen produces a change towards the red end, or, on the contrary, that decrease in the positive element does the same. The facts seem rather to show that colour in any body is dependent upon the proximity of its molecules, since we find bodies which, with like chemical composition but different densities, have different hues.

The metachromatic scale given on page 298 is not intended to be absolute, and may, in fact, need a little modification with the accession of more knowledge. But certainly Mr. Petrie's remarks do not affect it, because (1), the colour gradation he refers to is attended by chemical differences, whereas in metachromatic phenomena we have purely physical alterations; (2) white does not come between yellow and blue, either in the "natural" or in the metachromatic arrangement. For if by "natural arrangement" he means that of the pure spectrum, then green is what intervenes between blue and yellow, and white has its nearest counterpart in the ultra-violet grey. Quite recently this part of the spectrum has been termed "silvery grey" by M. Sauer. Independently of this, however, I was led to place white in the ultra-violet part of the metachromatic scale by certain mineralogical facts which I shall not trouble your readers with detailing here.

The assertion, then, that white comes between yellow and blue, would seem to rest upon the colour relation found to obtain between the oxides of the alkali metals, which really is not worth much, because of the little we know about the sub-oxides; and because even the chief series he gives, that of sodium, is an exception to the rule, Na_2O_2 being pure white (Watt's "Dictionary," vol. v., p. 340), and not orange, as Mr. Petrie states; and, finally, because we cannot fairly compare the order of colour we see in the binary compounds with what we get in metachromatic phenomena, although to a great extent there is a colour parallelism which is remarkable.

WM. ACKROYD

Royal College of Chemistry, South Kensington,
March 4

The U.S. Survey Publications

IN NATURE, vol. xiii. p. 314, I observed a note upon the rumour that the publication of Prof. Hayden's Geological Reports was likely to be stopped by the U.S. Government.

Having brought the paragraph under the notice of the Museum Committee of the Town Council, I am requested by them to communicate with you, and to say that several of these Reports have been received by the Leicester Museum, and are regarded as of great value; and that the Museum Committee will be glad